# MATERIALS CONSIDERATIONS FOR MISSION TO TITAN

## ENAE 788

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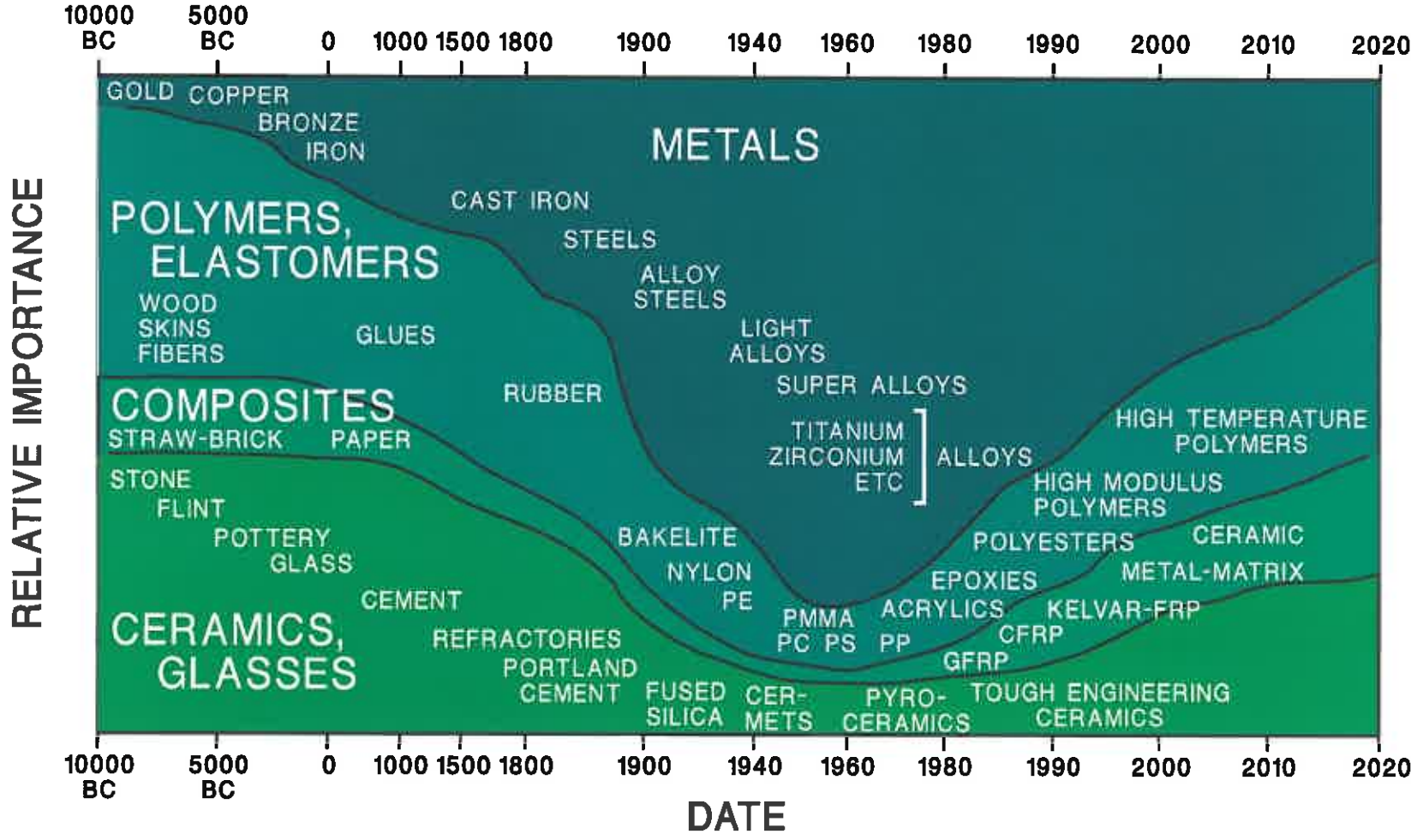
# Titan Environment

- Temperature: -180°C
- Atmosphere compared to Earth:
  - 1.5x pressure
  - 4x density
  - 1/7 gravity
  - Nitrogen-methane

# Where are Materials Needed?

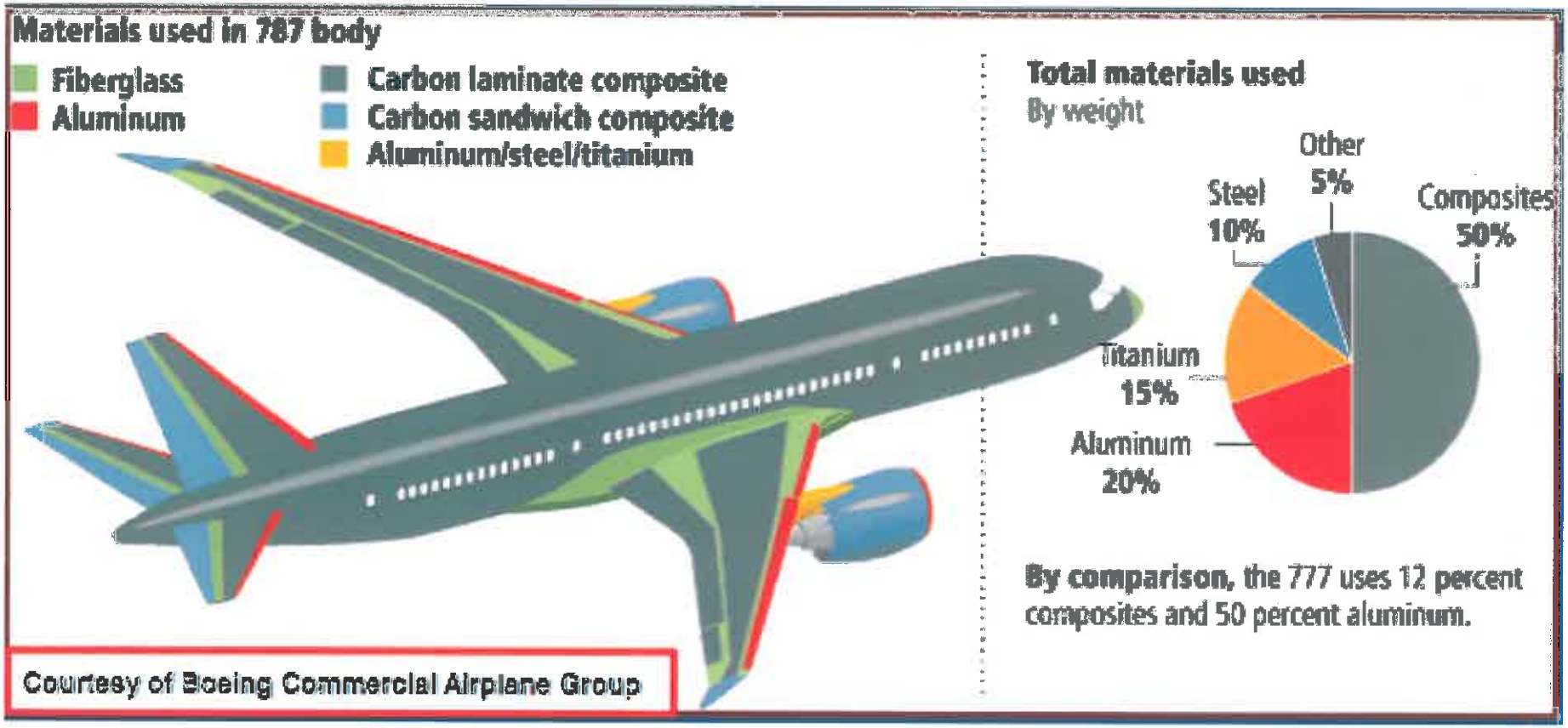
- Vehicle structures
- Power and propulsion
- Instrumentation
- Avionics

# General Classes of Materials

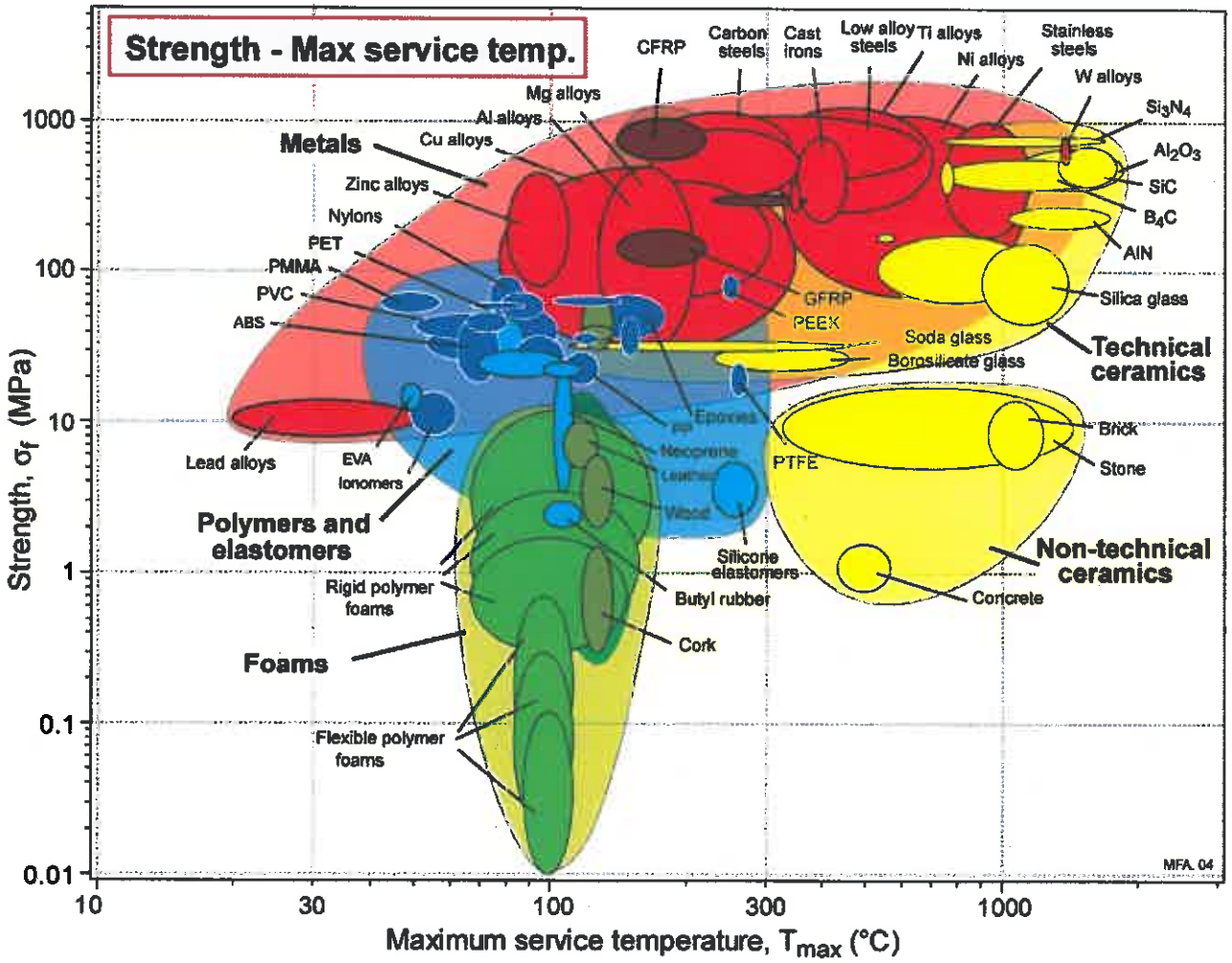



From: Ilhan Aksay, Princeton University, 2003

# Boeing 787

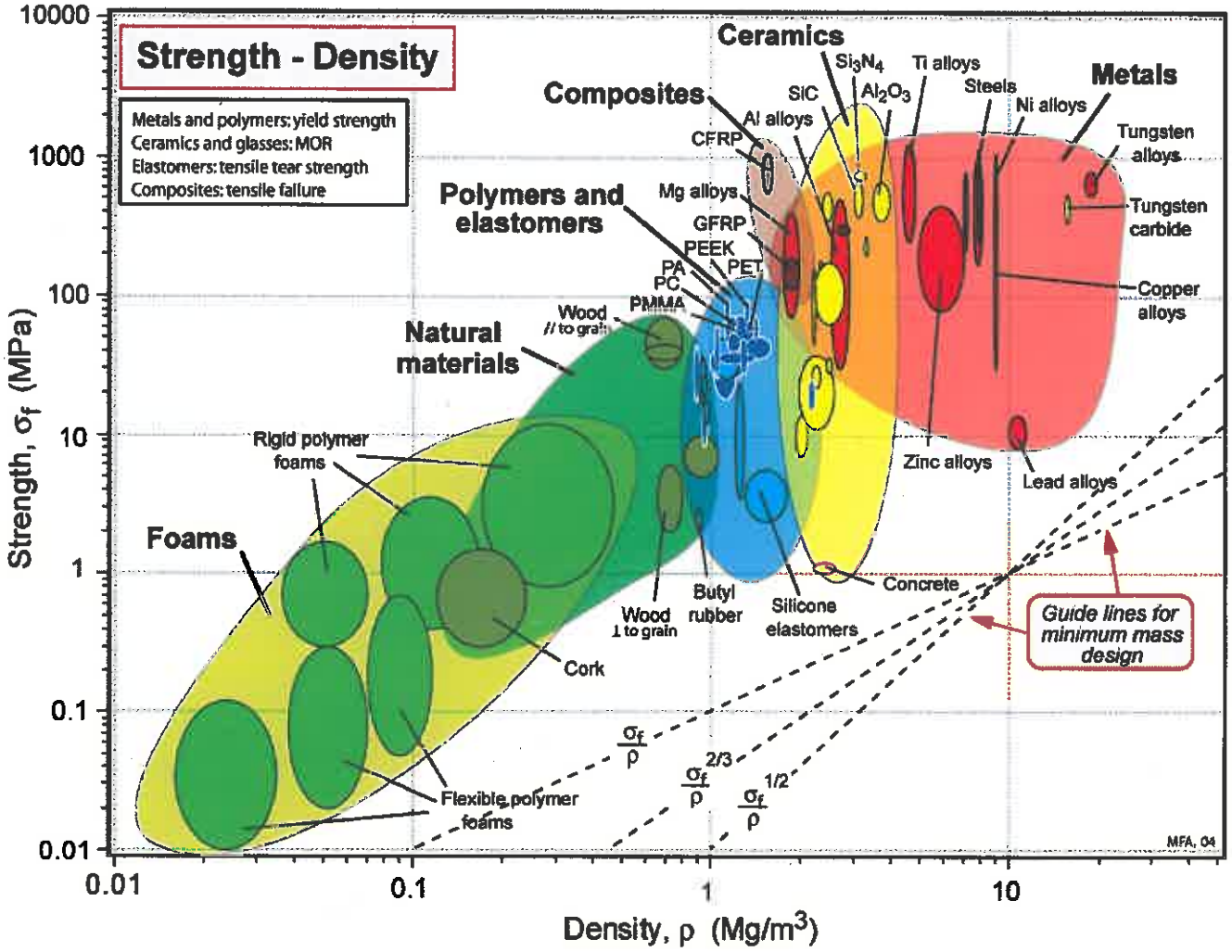

Materials used in 787 body
Fiberglass
Aluminum
Carbon laminate composite
Carbon sandwich composite
Aluminum/steel/titanium
Courtesy of Boeing Commercial Airplane Group
Total materials used
By weight
Other
5%
Steel
10%
Composites
50%
Titanium
15%
Aluminum
20%
By comparison, the 777 uses 12 percent composites and 50 percent aluminum.

# Effect of Temperature on Material Properties




http://www.mie.uth.gr/ekp_yliko/2_materials-charts-2009.pdf

# Trading Performance and Mass

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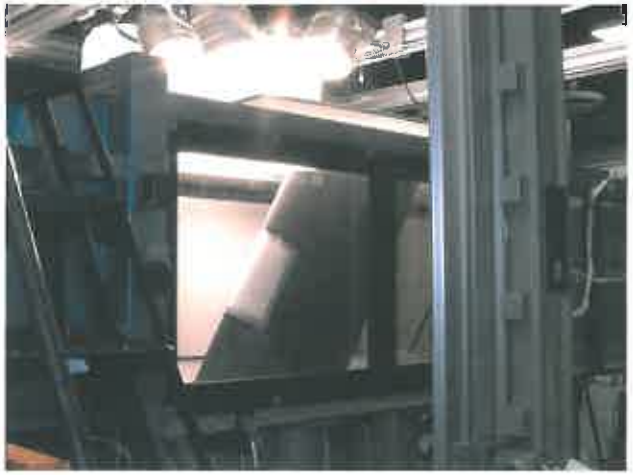
# Evaluation – Lab vs Use Environment

Fundamental Materials Screening

Bench Scale Testing



Simulation of Use Environment

Testing in Relevant Environment

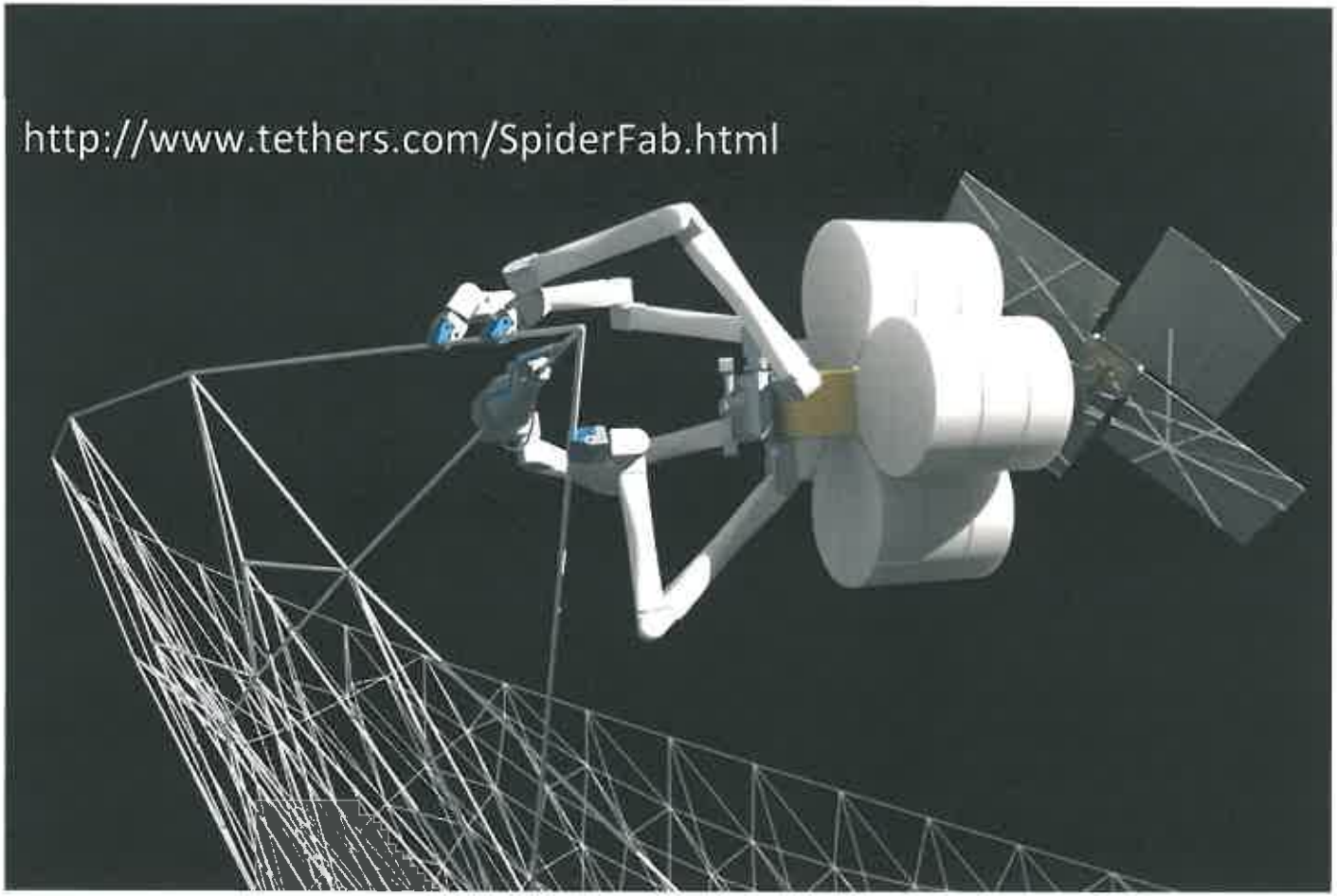
# Design Considerations

- Enabling integrated functionality through advanced materials


http://icesat.gsfc.nasa.gov/icesat/photogallery/glas-itgallery.php

Embedded Functionality

# Systems Designs Influenced by Materials




Materials Driven Innovative Deployment Design Concepts


THANK YOU